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Fire Blight of Apples and Pears

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Fire blight is one of the greatest hazards of the apple and pear industry. The losses occasioned by it are enormous. It is doubtful if any other disease of apples and pears causes a greater annual loss. Young orchards consisting of susceptible varieties may be wiped out in one season, and the crop in bearing orchards may be reduced from 25 to 50 per cent or more. The loss of fruiting wood (fruit spurs) may be great enough to reduce greatly the quantity of fruit produced for several years or even permanently. Some varieties of these fruits are much more susceptible to the disease under Missouri conditions than others.

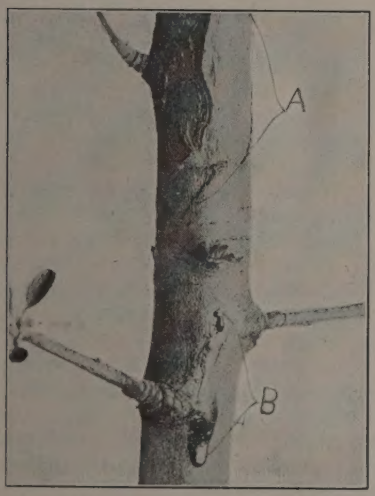

Fig. 1.—A three-year-old York apple branch showing the honey-like exudation from a hold-over fire blight canker located near the top of the tree. Bracket A indicates the position of the dead, sunken bark, while Bracket B locates the sticky exudate just below.

The most effective remedy so far discovered for fire blight consists of ridding the fruit plantation of the source of the disease. Pruning, cutting out and burning the so-called "hold-over" cankers during the winter in pear and apple orchards should be helpful. The eradication of hold-over cankers should be supplemented by the control of injurious insects which spread fire blight. To these control measures should also be added the regulation of the growth of the trees, and if the grower gives some attention to the matter of growing the more resistant varieties he will generally succeed better against fire blight.

The disease was known and described in the Hudson River Valley of New York as early as 1794, and it now occurs not only in the United States and southern Canada but in Australia, Italy and probably other countries. Fire blight is widely distributed throughout the United States. In the western states fire blight is regarded as the most destructive disease of the pear, having threatened the pear industry and caused millions of dollars of damage and heavy expenditures of money

for control and prevention. It was probably brought to the West from the eastern states about 25 or 30 years ago.

NAMES OF FIRE BLIGHT

The disease is generally known as fire blight, although other common names are given it such as *pear blight, blossom blight, twig blight, fruit blight, blight canker, collar blight, blight, sun scald* and *canker*. Since the name fire blight may be applied to the disease on any of its host plants it is the most appropriate common name. The names mentioned are often applied to the disease in various combinations. In every instance, however, they mean the same disease or the same organism causing the malady.

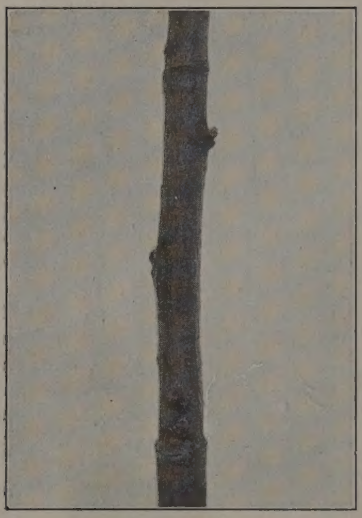

Fig. 2.—Fire blight canker on a pear branch. Note the shrunken condition of the affected area and the line of demarcation between the dead and live bark.

APPEARANCE OF FIRE BLIGHT

Fire blight may affect seriously the tender leaves, twigs and fruit blossoms. As a result, the injured parts appear blackish or brownish, resembling the effect of scorching by fire; hence the name fire blight. During severe cases of infection the entire outer surface of the trees may take on a brown or blackish appearance due to the killing of the new growth of leaves and twigs. At times the fire blight affects the blossoms more seriously than the leaves and twigs. Where this is true, the blossoms wither, turn brown or black, and finally die. Blossom infection may range from 5% or less to 75% or more.

On the twigs, branches and trunks of both pears and apples the disease causes the bark to wither and separate from the green live bark. The point at which the dead bark is pulled away from the live bark is generally indicated by an open crack or line, which is often referred to as the line of demarcation. The sunken areas and the lines separating live and dead bark are very characteristic of fire blight and are important factors to be taken into consideration in identifying the disease. Figure 2 shows the shriveling and separation of the dead tissues of the bark from the live and the line of demarcation is very distinct. The dying and dead bark may appear as water soaked and assume a blackish or brownish color. See Figure 3.

FRUITS AFFECTED AND EXTENT OF INJURY

Fire blight is most injurious to pomaceous fruits such as the pear, apple, quince wild crab apple, hawthorn and Juneberry. It has also been reported as affecting slightly the apricot and the plum. Pear and apple nursery stock often suffer seriously from fire blight. In some cases apple nursery stock may even be more seriously injured than pear. The disease attacks the leaves, twigs, fruits, branches,

trunks and roots of the trees. Usually however, the twigs and blossoms suffer most. Twig infection may in one season proceed from the current season's growth into wood one, two or more years old.

CAUSES AND SYMPTOMS OF THE DISEASE

Fire blight is a bacterial disease caused by *Bacillus amylovorus* (Burr.) Trev. The entire life of the organism is passed within the softer tissues of the bark, cambium and new wood of the living plants. It passes the winter in hold-over cankers, mainly on pear trees, although a few varieties of apples like Jonathan, York and Transparent may develop hold-over cankers in the spring and early summer which will afford a place for the disease to pass the winter. The organism passes the winter in a dormant condition in the tissues near the margin of the blight cankers.

In the spring the bacteria become active, multiply rapidly and affect the adjoining healthy tissues. From the margin of these cankered areas, particularly on the pear, a sticky exudation teeming with blight bacteria may ooze out on the bark. It has the appearance and consistency of honey and may stand in little beads on the young blighted leaf stems, twigs and fruits. This bacterial ooze is a source of infection. Some investigators have believed it possible for the bacteria in the exudations to be carried by wind-borne mists, although this belief is generally discredited for Missouri conditions. Rain drops may spread the disease by spattering the honey-like ooze to the leaves, twigs, and branches. The exudations from the cankers are also diluted by rain and run down the twigs and branches, causing infection, particularly where abrasions in the bark occur. See Fig. 1.

Fig. 3.—Pear twigs killed by fire blight. Note the shrinking and cracking of the bark.

INSECTS AS CARRIERS OF FIRE BLIGHT

The insects of most importance in carrying and spreading fire blight are aphids, bees, flies, wasps, bugs, curculios and leaf hoppers. Sucking types of insects which are capable of thrusting their beaks into the tissues of diseased plants to suck out the juices seem more likely to be carriers of fire blight germs than other types of insects. Insects may also feed and walk upon the honey-like exudations from fire blight cankers. In so doing their feet, legs, mouth parts and bodies may become contaminated with the germs of fire blight. In visiting the opening fruit blossoms and the tender leaves and twigs the insects may introduce the disease. See Fig. 5.

The honey bee is often unjustly accused in this regard. It is true that the honey bee may spread the disease from blossom to blossom, but it is not believed to be as injurious in the dissemination of fire blight as certain other insects, particularly the aphids. Furthermore, since the honey bee is largely responsible for the work of

cross pollination in our orchards, the grower cannot afford to eliminate it from the fruit trees. It would be impossible to secure a satisfactory set of fruit in most apple and pear orchards were honey bees excluded. The honey bee in Missouri is worth more as a disseminator of pollen from one variety to another than as a honey producer.

Fig. 4.—The curved line in the top of this blighted York apple tree represents the approximate extent of injury downward. The damage occurred about a year ago and the dead leaves still cling to the blighted branches.

HOLD-OVER CANKERS AND WINTER INJURY

Growers often mistake winter injury for fire blight. These affections may be easily distinguished. Winter injury is usually manifested early in the season by the injury on the trunk, in the crotches of the larger branches or at the base

of the tree trunk where it joins the ground. Winter-injured trees may start into growth and later die. The foliage of such trees generally shows a uniform browning and rarely will one find the injured areas sunken and surrounded by a definite line between the healthy and injured portions. No exudation or sticky substance oozes from the cankered or injured places in the case of winter injury, as is likely where fire blight occurs. No water soaked appearance is observed on the trunk or branches and there are no blighted twigs as is true with fire blight.

One striking characteristic of fire blight which is not common to winter injury or other diseases of fruit trees, is that the leaves and fruit killed by the disease may cling tenaciously to the dead twigs. Such leaves and mummied fruit may hang on the trees until the following season. Figure 4 shows a York apple tree coming into leaf with fire blight damage of the previous year. The curved line represents the approximate extent of injury downward. The dead leaves are still clinging to the blighted twigs. The leaves, young fruits and shoots infected with fire blight are of a black and blackish brown color instead of the more brownish color shown by other diseases. Attention to these outstanding differences should enable the grower without great difficulty to distinguish between fire blight and winter injury.

INFLUENCE OF WEATHER

When cool, damp weather exists during the early spring and continues until the beginning or middle of summer, fire blight is generally much more injurious. It is common knowledge of every grower that during cool, wet springs the attack of the aphids may be more serious than during warmer and dryer spring weather. Growing conditions are also generally better for the fruit trees and for the blight organism when there is plenty of moisture and sultry weather. Abundance of moisture is usually associated with a considerable amount of cool and cloudy weather. This prolongs the activity of aphids, which are undoubtedly responsible for spreading fire blight badly. In general, such conditions promote greater vegetative growth or growth which is of a more succulent nature. Soft, succulent growth is more severely affected than shorter, harder and slower growth produced under dryer and warmer conditions.

Fig. 5.—An apple branch showing the fire blight infection through the fruit, flowers or blossoms. Since no injury occurs on the non-fruiting spurs, insects are believed to be responsible for this blossom infection.

Comparatively cool, rainy weather extends the blossoming period, during which time insects have a greater opportunity to spread the germs of fire blight. Fire blight is more severe during the period of most rapid growth of the trees and especially during moist periods of weather. The disease may spread rapidly enough

to damage an entire orchard in a few days' time, while in other instances it may progress very slowly. Upon the approach of dry weather it generally ceases to spread.

INFLUENCE OF CULTIVATION AND FERTILIZATION

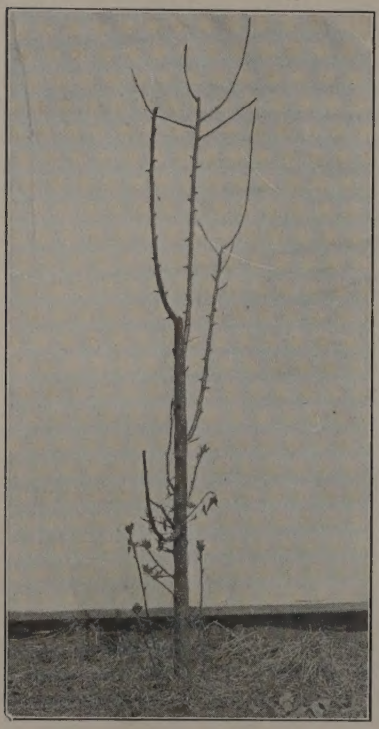

Fig. 6.—A Wagener apple tree set two years in the orchard and killed back to near the ground by fire blight. Growth is starting from live bark within a few inches of the ground.

Cultivation and fertilization may have a marked influence on the control of fire blight. This is particularly true of pears. If the cultivation and fertilization causes a rank, succulent growth, it is much more likely to be affected by fire blight. What is desired is a slow steady, uniform, fairly vigorous growth. Such a growth will usually develop stockier, hardier twigs which are much less liable to injury. It is important that young and old apple and pear trees make a satisfactory growth each season, but it is also important that they do not make so much growth that they may be seriously injured by the fire blight.

Pear and apple orchards should never be cultivated late in the season, say after August first. Such cultivation is likely to cause new growth which may continue to spread the fire blight. Severe pruning should also be avoided on susceptible varieties, because severe pruning tends to produce a rank, tender growth which is more likely to be affected by the disease.

Pear trees upon many soils require but little if any cultivation or fertilization, while apple trees may usually be cultivated in almost all orchards without danger of subjecting them to serious injury by fire blight. On some fertile soils, however, the addition of fertilizers may cause too rank a growth. The grower, therefore, must study his trees and regulate the growth in a way that will be satisfactory for the proper health and development of the trees without unduly subjecting them to attack from fire blight.

EFFECT OF SPRAYS

The various sprays which are applied to fruit trees are not a direct remedy or control for fire blight. They may be of great advantage, however, in that they control some insects which spread the disease, and thus sprays may indirectly assist in its control. This is particularly true in the control of aphids. Some investigators have shown that there is a correlation between the abundance of aphids and the prevalence of fire blight. For example, varieties like Jonathan, which are

susceptible to the disease, are generally infested worse by aphids than varieties like Winesaps, which are fairly immune to the disease and which usually do not show as much injury from aphids. The control of other insects no doubt helps materially in reducing the amount of fire blight, because many of them may at times serve as carriers of the fire blight germs.

GENERAL PLAN OF CONTROL

(1) **Cut Out and Burn the Hold-over Cankers.**—In the control of fire blight the first and most important object should be ridding the orchard of the source of the disease. Since the hold-over cankers found mainly on pear trees are the source, these are the first factors requiring the attention of the grower. A few badly blighted pear trees are of little if any economic importance, but they may act as the main source of blight infection for many acres of apples. The destruction of such diseased pear trees before growth starts is emphasized. In the regular dormant pruning work, the grower should also be careful to remove and burn the blight cankers from all apple trees, as some varieties of apples, as well as all varieties of pears, may have hold-over cankers. In removing the blighted twigs and cankers, it is well to cut all infected twigs from 6 to 8 inches below the cankered area in order to be sure of eliminating all the parts infected with the fire blight bacteria. The hold-over large limbs and the trunk should be treated likewise, removing the cankers on bark about 6 inches above and below and from 2 to 4 inches on the side.

Such cuts and wounds should be disinfected with a 1-500 solution of equal parts of bichloride of mercury and cyanide of mercury. To prevent spreading the disease, the pruning implements should also be disinfected after each cut by washing or dipping them in the disinfectant. The disinfectant may be applied to the wounds and pruning tools by means of a sponge or several thicknesses of a soft cloth tied around a stick about 12 to 16 inches long. All cut surfaces should be painted after the disinfectant has dried, using ordinary barn paint white lead and raw linseed oil. Since these disinfectants are highly poisonous, great care should be taken in handling them.

If pruning is done during the growing season, the wounds should be disinfected and painted promptly. Cutting out blight and burning the diseased wood during the dormant season is recommended. It is, however, impractical to attempt to cut out during the spring or summer the thousands of blighted twigs that may appear in large trees. The germs of blight in these dying twigs are very short lived and may have run their course and become incapable of causing new infection before the twigs are cut away.

Since it is very probable that fire blight may be carried over winter on the crab apple and hawthorn such infected trees in the vicinity of apple orchards should be destroyed or given fire blight treatment as applied to pear and apple trees.

(2) **Control Injurious Insects.**—This includes fruit tree borers, sucking insects like aphids, and leaf hoppers; and biting and chewing insects like the curculio and the codling moth. There are many other good reasons for the control of these insect pests. Fire blight alone, however, is a sufficient reason for their control, since all, at times, may become carriers of the disease.

(3) **Regulate the Growth of the Fruit Trees.**—It is more important that the pear make a slow, steady and uniform growth than the apple, because as a rule it is more seriously affected by fire blight. Both fruits, however, should be given close attention as regards growth. The grower at all times should see that the trees make a fairly strong, vigorous, satisfactory growth. With young trees this is very important. Should fire blight become serious, however, it may be necessary to check the growth of the trees by withholding fertilization and cultivation, one or both practices, depending upon the need.

TREATMENTS OF NO VALUE

Driving rusty iron nails into the trees and hanging horse shoes among the branches will not control fire blight. Unscrupulous agents have sold growers many worthless blight remedies. Treatments of the soil with iron filings, salt and wood ashes have been advocated. Injections of salt, calomel, iron and other materials into the trees have been recommended. As yet none of these have been found of any use and it is doubtful if they ever will be.

VALUE OF RESISTANT VARIETIES

Where fire blight is a serious problem, it will behoove the grower to give some attention at least to the matter of planting resistant varieties.

There is no commercially profitable variety of either pear or apple which is entirely immune to fire blight, yet there is a great difference in susceptibility. Under Missouri conditions the most susceptible commercial varieties of apple are York, Jonathan Transparent, Benoni, Willow, Early Harvest, Wealthy, Rome, and Maiden Blush. Those that might be classed as moderately susceptible are Ben Davis, Gano, Missouri (Pippin), Grimes, and Ingram; while the most resistant varieties are Winesap, Delicious, Oldenburg (Duchess), Collins and Staymen.

In the case of the pear, we seldom plant the Bartlett because it is so susceptible to the disease. Fire blight generally injures Bartlett, Clapp Favorite and Flemish Beauty more seriously than such varieties of pear as Kieffer, Garber, Seckel and Lincoln. The Kieffer is perhaps more resistant than any other commercial variety grown in Missouri. With the Kieffer, however, the grower should plant one or more of the resistant sorts in order to secure the benefits of cross pollination.

In the case of apples, most of our standard varieties may be grown in any locality without serious injury from fire blight if the grower gives attention to the control measure mentioned above.

NEED OF COOPERATION

As in the control and prevention of other serious diseases of fruit trees and insect pests, much can be accomplished by community effort or cooperation. It is evident that one grower who allows his pear trees to become badly infected by fire blight may furnish a source of infestation to an entire community. Other growers although practicing the best fire blight control measures at great expense, may fail on account of the one negligent or indifferent grower.

Many states, particularly in the West, have passed stringent laws regarding the control and prevention of fire blight. Since fire blight may be classed as a dangerous plant disease, it comes within the scope of the new Plant Inspection Law passed by the Missouri General Assembly in 1925. The passing of laws regarding such matters is of no value, however, unless the fruit growers individually and collectively are willing to enforce them. By championing such laws the growers certainly will increase their own profits and add to the stability and importance of the fruit growing industry.